# NASA TECH BRIEF

*Marshall Space Flight Center*



## A Brushless D. C. Spin Motor for Momentum Exchange Altitude Control

### The problem:

Conventional ac induction motors, when used in conjunction with a static inverter momentum wheel, have several deficiencies. The system is bulky; it requires too many watt-hours to accelerate the momentum wheel; and once running, consumes excessive power to keep the wheel in motion.

### The solution:

A brushless dc spin motor (see figure) has been designed to use Hall effect probes as a means of resolving rotor position and controlling motor winding currents. This results in a 3 to 1 reduction in watt-hours required for wheel acceleration, a 2 to 1 reduction in power to run the wheel, and a 10 to 1 reduction in the electronics size and weight.

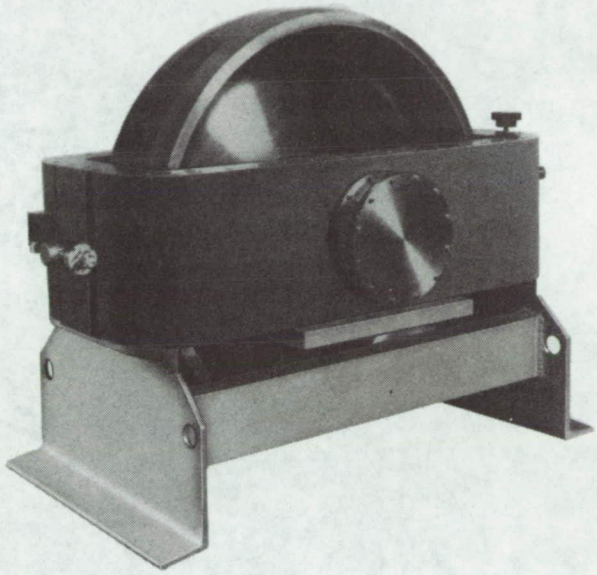
### How it's done:

The motor uses a stator (either two- or three-phase winding), a main permanent magnet rotor, a flux return path ring for the sensing rotor, and two Hall effect probes located in the air gap of the sensing rotor.

Two armature windings, electrically displaced by 90°, are provided on the stator. The motor is energized by two power amplifiers which are controlled by two Hall probes that sense the magnetic flux of the auxiliary sensing rotor.

The sensing rotor is aligned with the main rotor so that the voltages of the Hall effect probes are proportional to the magnetic flux from the main rotor. By suitably magnetizing the rotors, the flux density around the periphery of both rotors can be made to vary sinusodially. The probe voltages are the inputs to the power amplifiers that provide the currents to the armature windings.

This motor has a normal operating speed of 8,000 rpm and an operating life of 9,000 hours. It has a nominal torque of 1590 gm-cm and a peak output power of 133 watts.



### Notes:

1. This innovation may be of interest to designers of high speed, high efficiency motors and the aerospace industry in general.
2. Requests for further information may be directed to:
   Technology Utilization Officer
   Marshall Space Flight Center
   Code A&TS-TU
   Huntsville, Alabama 35812
   Reference: B72-10448

### Patent status:

No patent action is contemplated by NASA.

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